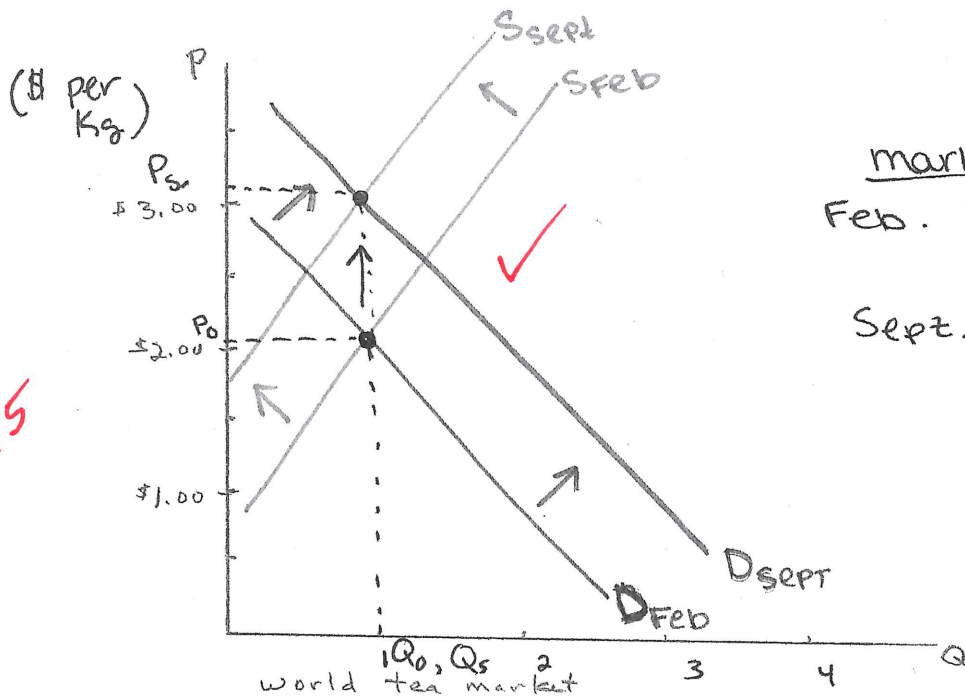


100 points total. Point values for each question are as indicated. Answer each question in the space provided. General advice: show your work, including any formulas or diagrams that you use in reasoning through your answers.

- (15 pts.) "Remote working arrangements and other home routines established during the coronavirus pandemic have led more people to reach for cups of tea, which is consumed in larger amounts world-wide than any drink other than water. But supplies of tea leaves are tightening, due to bad weather in some producer countries, labor shortages, port closures and other logistical issues." (WSJ 9/24/20). Prices in February were \$2.10 per kilogram, but had risen to \$3.20 by September. Using demand and supply analysis, illustrate and briefly explain what has been going on in the world tea market.



market-price equilibrium
 Feb. $P_0 = Q_0 = \$2.10 / \text{kg}$
 Sept. $P_s = Q_s = \$3.2 / \text{kg}$

From Feb. to September, there is an increase in demand for (increase in taste*) tea resulting in a shift of demand curve to the right. With the array of factors mentioned for supply, we would see a decrease in supply a firm can produce (logistically) and so we would see a market price equilibrium increase as the supply curve shifts to the left. Thus, tea is, in Sept., now at \$3.20 per kg.

2. (20 pts.) You work for the division of motor vehicles in the vehicle licensing department. Standard license plates are \$25 per year, but your department offers specialty license plates at a higher price. In particular, affinity plates for state universities are priced at \$70 per year. The DMV decides to experiment with changing the price, to see if it can increase revenues. When it raises price to \$80, the number of license plates sold for the flagship state university (think Big Blue) fall from 53,000 to 52,000. Calculate own-price elasticity of demand for Big Blue plates and explain whether you think this was a good move.

$$E_{x, P_x} = \frac{-\% \Delta X_D}{\% \Delta P_x}$$

$$= \frac{-\frac{(52000 - 53000)}{1/2(52000 + 53000)}}{\frac{(80 - 70)}{1/2(80 + 70)}} = \frac{-\frac{(-1000)}{52500}}{\frac{10}{75}} = \frac{0.0190}{0.1333}$$

$$E_{x, P_x} = 0.143 \checkmark$$

$$\text{as } E_{x, P_x} < 1$$

The change in price & quantity demanded is inelastic, thus showing that even with the price change, people are still willing to buy the custom plates. This is a good move as it will boost total revenue.

20

You observe that sales of affinity license plates for other universities fall off as well. For example, annual sales of the Red Bird version of the license plate decline by 25%. Calculate elasticity of demand for this version of the plate and explain how you might use this information to advise the DMV about their policy of pricing all university affinity license plates the same.

$$\% \Delta X_D = 25\%$$

$$E_{x, P_x} = \frac{0.25}{\frac{80 - 70}{1/2(80 + 70)}} = \frac{0.25}{\frac{10}{75}} = \frac{0.25}{0.1333} = 1.88 \checkmark$$

The sale & demand changes with the Red Bird version show elasticity as $E_{x, P_x} > 1$. This suggests that demand will drop greater than sales will increase, thus leading to loss of revenue. We can advise the DMV to adjust prices differently based on the type of plate. As people have a lot of school spirit for UK, they will be willing to pay more for a custom plate, where as this is just not the case for the Red Bird plate.

3. (15 pts.) Your friend Esmeralda works as a line cook at a local restaurant, earning \$45,000 per year. Feeling entrepreneurial, she is inspired to start her own business. She decides to open a food truck and serve food to the campus lunch crowd. After operating this business for a year, she shares the following information with you and asks for your assessment of its profitability. She opens her publicly audited books to you and you see \$220,000 in revenues each year from food sales. You also see \$30,000 in labor costs for hourly workers who help her run the business, \$80,000 in wholesale food costs, \$10,000 for gas and maintenance on the truck, \$20,000 for insurance, taxes, and business license fees, and \$5,000 for advertising and web site expenses. What are Esmeralda's accounting profits?

- Total revenue from sale of goods = \$ 220,000
- Explicit costs of operating the business :
 - labor costs = \$ 30,000
 - whole sale food costs = \$ 80,000
 - gas and maintenance = \$ 10,000
 - insurance, taxes, and business license fees = \$ 20,000
 - advertising and web site expenses = \$ 5,000

$$\begin{array}{r}
 \$ 220,000 \\
 - \$ 145,000 \\
 \hline
 \$ 75,000
 \end{array}$$

Accounting profits =
✓ \$ 75,000

total : \$ 145,000

Esmeralda invites you to work alongside her for a while to help you assess other factors relevant to her business. You learn the following things. She works full time in her food truck but takes her compensation in the form of profits instead of paying herself a salary. Esmeralda owns her truck outright. Fully outfitted food trucks like hers cost \$80,000 when new, and have an expected life of four years, at which point they are worth nothing. Prior to buying her food truck Esmeralda had the \$80,000 parked in an indexed mutual fund where she earned 6%. What do you think of this business opportunity? Answer by calculating Esmeralda's economic profits (or losses), carefully explaining your logic.

15

- Accounting profits = \$ 75,000
- Implicit costs :
 - opportunity cost of her time = \$ 45,000 ✓
 - foregone interest on mutual fund = \$ 4,800 ✓
 - economic depreciation (annualized) = \$ 20,000 ✓

$$\text{Total} = \$ 69,800$$

$$\text{Economic profits} = \text{Total revenue} - \text{total explicit costs} - \text{total implicit costs}$$

$$\$ 220,000 - \$ 145,000 - \$ 69,800 = \$ 5,200$$

$$\text{Economic profits} = \$ 5,200 \checkmark$$

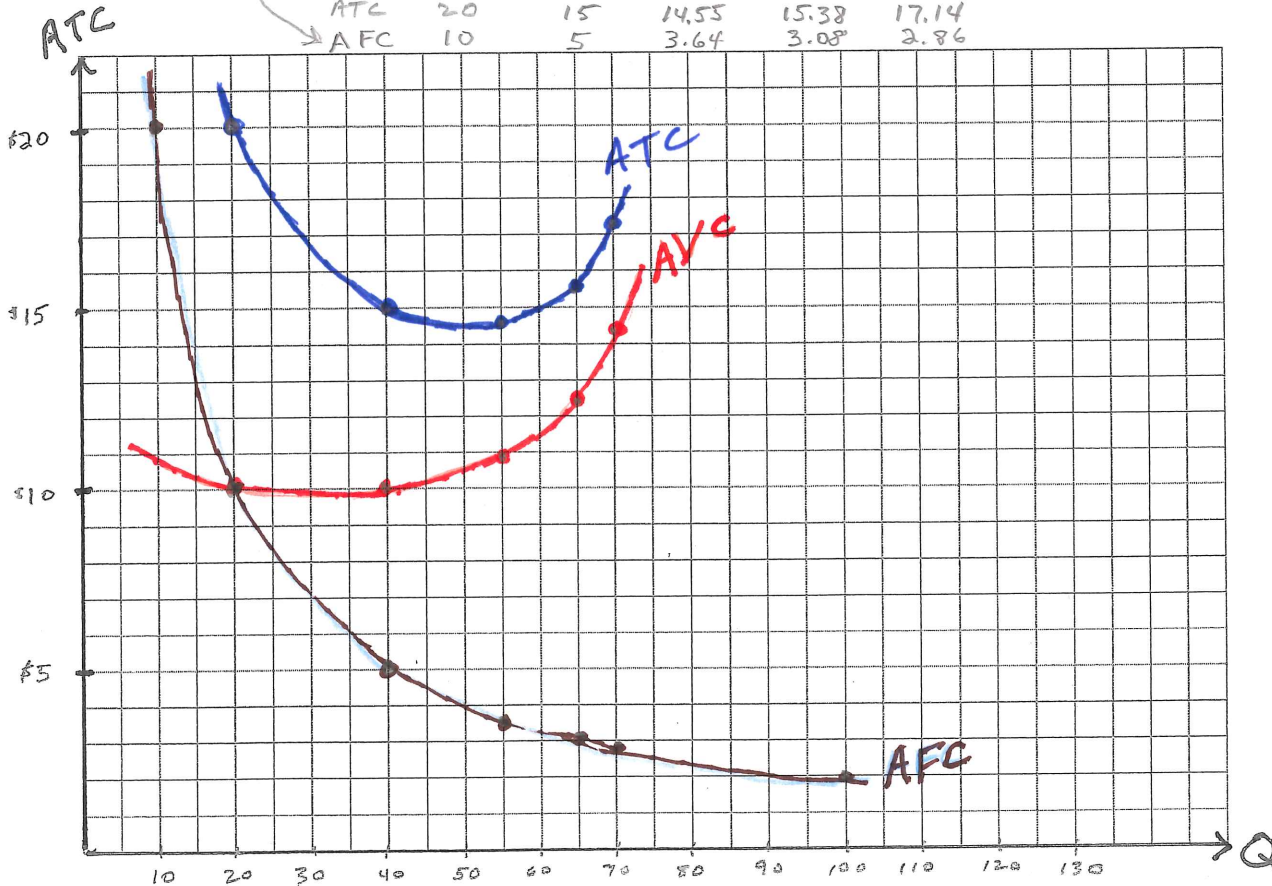
Esmeralda is doing \$ 5,200 better than if she were working as a line cook at a local restaurant. I think she should continue operating the food truck.

4. (15 pts.) The following table describes the short-run production relationship for a firm that produces long-term nursing care. It operates nursing homes in a number of different communities. It produces a single output, Q , i.e. the number of patients housed in a given facility. It uses two inputs, L , healthcare workers, and K , physical facility and healthcare equipment. Suppose that the daily per unit price of L is \$200 and the daily per unit price (implicit rental rate) of K is \$200. Suppose the firm decides to build a small-sized nursing home in a particular community, i.e. it chooses $K=1$. Using information from the table, sketch the firm's short-run average fixed cost, average variable cost, and average total cost curves in the diagram below, showing specific points on each curve based on your calculations, that correspond to K being fixed in the short run at $K=1$.

		Labor Input				
		1	2	3	4	5
Capital Input	1	20	40	55	65	70
	2	40	60	75	85	90
	3	55	75	90	100	105
	4	65	85	100	110	115
	5	70	90	105	115	120

$K=1$
 $TFC=200$

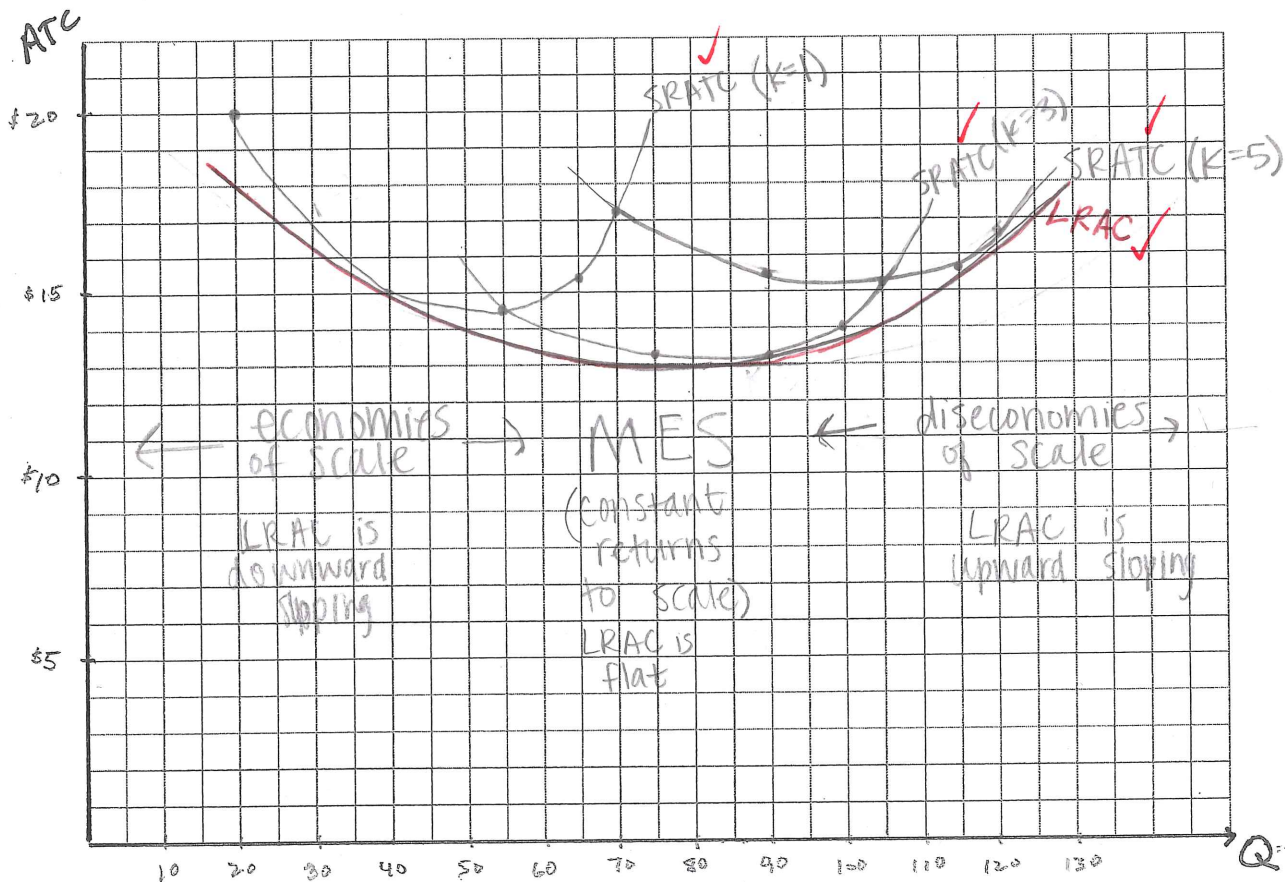
L	1	2	3	4	5
Q	20	40	55	65	70
TVC	200	400	600	800	1000
AVC	10	10	10.90	12.30	14.28
TC	400	600	800	1000	1200
ATC	20	15	14.55	15.38	17.14
AFC	10	5	3.64	3.08	2.86



5. (15 pts.) The firm is considering building a new nursing home in community that currently does not have any long-term care facilities. It is wondering how its per patient costs vary with the scale of its operations. In other words, it wants to know whether there are economies or diseconomies of scale. Calculate and graph its short-run average total cost curves for $K=1$, $K=3$, and $K=5$ (you have already done the calculations for $K=1$). Then illustrate and explain what its long-run average cost curve (LRAC) looks like, and whether it experiences economies or diseconomies of scale.

$SRATC = TC/Q$

	$K=1$	$K=3$ ($FC=600$)	$K=5$ ($FC=1000$)
$L=1$	20 $Q=20$	$(600+200)/55 = 14.55$	$(1000+200)/70 = 17.14$
$L=2$	15 $Q=40$	$(600+400)/75 = 13.33$	$(1000+400)/90 = 15.56$
$L=3$	14.55 $Q=55$	$(600+600)/90 = 13.33$	$(1000+600)/105 = 15.24$
$L=4$	15.38 $Q=65$	$(600+800)/100 = 14$	$(1000+800)/115 = 15.65$
$L=5$	17.14 $Q=100$	$(600+1000)/105 = 15.24$	$(1000+1000)/120 = 16.67$



The LRAC curve envelopes all the SRATC curves into one curve. Based on this LRAC, the firm is experiencing economies of scale when $K=1$ and diseconomies of scale when $K=5$. When $K=3$, the firm operates at minimum efficient scale.

6. (5 pts.) If the firm were considering entering a small market community that would likely only generate 40 patients at any point in time, what scale would you recommend and why? Use your diagram in the previous question in explaining your answer.

5
 ✓ I would recommend either $K=1$ and $L=2$ or $K=2$ and $L=1$ (same ATC). I would select this option as it has the lowest ATC (\$40) associated with serving 40 patients at any one point.

7. (10 pts.) On the "Make-or-Buy Continuum" which goes from arm's length market transactions to perform activity internally, explain where the relationship between chicken farmers and chicken processing plants falls and why, and then explain where the relationship between cattle farmers and beef processing plants falls and why. Knowing what you do about changes that occurred in pork production in the 1980s and 1990s, what sort of relationship would you expect between upstream pork farms and downstream pork processing plants?

10
 ✓ Chicken farmers and processing plants are vertically integrated with one another. This is because thousands of chickens are processed in a farm, but there are fewer farms as such. Thus, processing plants want to have some control over when they get chicken from these more limited options, leading to integration. Conversely, there are many cattle farms which have a small amount of cattle. Because of this, beef processors have to worry less about when individual cattle farmers will supply them, and thus are less integrated. Finally, since pork has begun to move in a similar direction to chicken farms (fewer, larger plants), they would likely be more closely integrated with the processing plants.

8. (5 pts.) Using an algebraic expression, explain why Toyota outsources the audio systems in its Camrys to Bose.

5
 ✓ Toyota outsources due to economics of scope, e.g. producing the audio system alone would not allow Toyota to fully exploit the production process in their cars. This can be demonstrated in the algebraic expression:

$$TC(Q_1, Q_2) < TC(Q_1, 0) + TC(0, Q_2)$$

✓ Toyota would only be making one product (Q_1) like as Bose would be creating multiple products (Q_1 and Q_2) and thus could use the process more efficiently to decrease total costs.

6. (5 pts.) If the firm were considering entering a small market community that would likely only generate 40 patients at any point in time, what scale would you recommend and why? Use your diagram in the previous question in explaining your answer.

5 I would use 2 healthcare workers with 1 facility ($L=2, K=1$)
 At 40 patients this gives you the lowest average total cost for operating that can cover the full number of patients.

7. (10 pts.) On the "Make-or-Buy Continuum" which goes from arm's length market transactions to perform activity internally, explain where the relationship between chicken farmers and chicken processing plants falls and why, and then explain where the relationship between cattle farmers and beef processing plants falls and why. Knowing what you do about changes that occurred in pork production in the 1980s and 1990s, what sort of relationship would you expect between upstream pork farms and downstream pork processing plants?

10

Chicken farmers & Chicken processing plants fall under long-term contractual agreements. Chicken farming itself has significant economies of scale in production and efficient chicken farms produce a large supply of chickens. With such production it does not take many chicken farms to keep a large chicken processor fully supplied. However it does take extensive coordination that is necessary to keep chicken processing plants stocked and working efficiently. Because of the potential downstream effects of losing supply, long-term contractual agreements are the best option.
 Cattle on the opposite shows diseconomies of scale and farmers are cost-competitive with larger operations. They can rely on the production of hundreds of small cattle farmers for their supply so they fall under relying on arm's length.
 Being that the pork business has turned into more of an assembly line they would be more integrated and would fall more along the lines of strategic alliances & joint ventures.

8. (5 pts.) Using an algebraic expression, explain why Toyota outsources the audio systems in its Camrys to Bose.

5

$$S = \frac{C(q_a) + C(q_b) - C(q_a + q_b)}{C(q_a + q_b)}$$

$C(q_a)$ - cost of producing good 1 separately
 $C(q_b)$ - cost of producing good 2 separately
 $C(q_a + q_b)$ - cost of producing same quantities of good 1 & 2

It would cost Toyota more to set up the facilities & production line for audio systems because all this would be new rather than buying from an outside source that specializes in audio equipment and already has dedicated facilities.
 good!